

NON-PUBLIC?: N
ACCESSION #: 9002080103
LICENSEE EVENT REPORT (LER)

FACILITY NAME: Hope Creek Generating Station PAGE: 1 OF 8

DOCKET NUMBER: 05000354

TITLE: Reactor Scram During Performance Of Main Turbine Thrust Bearing
Wear Detector (TBWD) Surveillance Due To Malfunction Of TBWD
Limit Switch And Inadequate Prioritization Of A Pending Design
Change
EVENT DATE: 12/30/89 LER #: 89-025-00 REPORT DATE: 01/29/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: R.B. Cowles, Lead Engineer - TELEPHONE: (609) 339-5264
Technical

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 12/30/89 at 1947, during the performance of the TBWD section of the Main Turbine Monthly Functional Test procedure, a turbine trip occurred. This trip was followed immediately by a reactor scram via the Reactor Protection System on a turbine control valve fast closure signal. All control rods inserted, and plant systems responded as expected, with minor exceptions as noted in the text of this report. Investigation subsequent to the event determined that a TBWD limit switch had malfunctioned during the test, resulting in the turbine trip circuitry sensing that the turbine end thrust bearing had actually failed. While the initiating cause of this event was the TBWD limit switch failure, the root cause of this event was the inadequate prioritization of a design change which had been pending since 1988. This design change would have

modified the TBWD circuitry to prevent a turbine trip signal while testing the TBWD. Corrective actions included implementing this design change, repairing the TBWD limit switch, reviewing all other "scram reduction" design changes for adequate prioritization, reviewing other turbine trip test procedures for administrative adequacy, and incorporating this event into appropriate training programs.

END OF ABSTRACT

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PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)
Main Turbine (EIS Designation: TA)
Main Steam System (EIS Designation: SB)
Reactor Protection System (EIS Designation: JC)
Control Rod Drive System (EIS Designation: AA)
Rod Position Indication System (EIS Designation: IG)

IDENTIFICATION OF OCCURRENCE

Reactor Scram During Performance of Main Turbine Thrust Bearing Wear Detector (TBWD) Surveillance Due to Malfunction of TBWD Limit Switch and Inadequate Prioritization of a Pending Design Change

Event Date: 12/30/89

Event Time: 1947

This LER was initiated by Incident Report No. 89-184

CONDITIONS PRIOR TO OCCURRENCE

Plant in OPERATIONAL CONDITION 1 (Power Operation), Reactor Power 100%, Unit Load 1118 MWe. Monthly turbine generator surveillance procedure in progress.

DESCRIPTION OF OCCURRENCE

On 12/30/89 at 1947, during the performance of the Main Turbine Monthly Functional Test procedure, a turbine trip occurred. This trip was followed immediately by a reactor scram via the Reactor Protection System (RPS) on a turbine control valve fast closure signal. All control rods inserted, and plant systems responded as expected, with the following exceptions:

- Safety Relief Valve (SRV) "H" (lo-lo set) lifted as designed, but SRV "P" (also a lo-lo set) did not. Additionally, SRV "M" lifted, apparently at a pressure lower than designed.
- Control rod 34-27 did not properly indicate rod position. Additionally, operators did not initially receive a "full-in" indication on rod 34-11.
- Scram Discharge Volume drain valve 1BF-HV-F011 did not give an open indication after the scram signal was reset.
- Operators could not immediately restart Reactor Recirc Pumps "A" and "B".

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DESCRIPTION OF OCCURRENCE, CONT'D

During the transient, vessel level decreased to approximately +2 inches, which is 40" above any Emergency Core Cooling System (ECCS) actuation setpoints. Vessel level was restored to normal (+35 inches) using the "A" RFP. Following stabilization of plant parameters, a four hour non-emergency by report was made to the NRC Operations Center IAW 10CFR50.72 and station administrative procedures, and an investigation was initiated to determine the cause of the scram.

ANALYSIS OF OCCURRENCE

The monthly TBWD test is performed in the control room at the TBWD panel (see Attachment 1). This test temporarily bypasses the thrust bearing wear turbine trip circuit, and exercises the wear detector mechanism through its limits of travel. When the "TEST TURBINE END" pushbutton on the TBWD panel is depressed, the following actions occur:

- The "TEST TURBINE END" pushbutton backlights
- The "TESTING" lamp is illuminated
- The "THRUST BEARING WEAR DETECTOR" indicator moves in the negative direction.
- At the turbine mid-standard, the actual TBWD mechanism test drive motor starts to move in the direction of the turbine.
- On the TBWD mechanism, a cam operated limit switch (TWS-11) closes to maintain the detector in "TEST" while during performance of the test.

When the TBWD reaches the turbine trip setpoint (approximately -40 mils), the test motor stops, and the "TEST TURBINE END" pushbutton is released.

With TWS-11 still closed, the TBWD drive motor should run back to the 0 of (neutral) position, which completes the test.

Contrary to this normal scenario, during the performance of this test on 12/30/89 at about 1947, the drive motor did not drive back to the "0" position when the Nuclear Control Operator (NCO, RO licensed) conducting the test released the "TEST TURBINE END" pushbutton. With the TBWD still above the turbine trip setpoint, and the pushbutton released, a five second time delay relay was de-energized (the relay maintains the circuit in a "test" condition while the pushbutton is depressed).

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ANALYSIS OF OCCURRENCE, CONT'D

Because of a malfunction of limit switch TWS-11, the drive motor did not energize to run the TBWD back below the trip setpoint, and after 5 seconds, a turbine trip occurred, and as previously noted, an RPS-initiated reactor scram occurred.

Investigations conducted subsequent to the scram focused on the conduct of the test procedure, content of the test procedure, the apparent equipment failure of TBWD limit switch TWS-11, the NCO's knowledge of the test requirements, and a previously identified design change which had not been implemented. It should be noted at this point that this scram is very similar to a scram which occurred on 8/26/88 (refer to LER 88-022).

With respect to conduct of the procedure, it was determined that the NCO followed the procedure in a proper manner. The procedure cautions the performer that if the indicator does not move back toward "0" when the "TEST TURBINE END" pushbutton is released, to depress and hold the pushbutton (to prevent a turbine trip) and to immediately call for assistance. When the NCO realized that the indicator was not moving, he immediately reached for the pushbutton, but the turbine tripped before he could depress the pushbutton.

The TBWD test procedure was reviewed for adequacy. While a previously identified change had not yet been incorporated into the procedure at the time of this incident, the procedure was functional as written, and had no bearing on this event.

The proper functioning of limit switch TWS-11 was investigated. When reviewing the equipment history of TWS-11, it was determined that a malfunction of this limit switch (a loose limit switch arm) caused an

almost identical scram in 1988, as previously noted. Subsequent to the 1988 scram, another switch had been installed. The subject test had been performed two times previous to the scram noted in this report with no apparent precursory results that would indicate the switch was not functioning properly. Immediately following the scram, the Senior Nuclear Shift Supervisor (SNSS, SRO licensed) proceeded to the TBWD mechanism at the main turbine, and discovered that the drive mechanism was stopped at about -40 mils. When he tapped the drive mechanism, it energized and drove to "0". This troubleshooting by the SNSS produced the only witnessed failure of the limit switch. Subsequent troubleshooting could not reproduce the actual failure, but determined that a less than optimum alignment between the cam and limit switch and a loose terminal screw inside the switch were the primary contributors to the switch failing to properly operate.

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ANALYSIS OF OCCURRENCE, CONT'D

In reviewing the NCO's familiarity with the test being performed, it was noted that this was the first time the NCO had performed this test. However, the NCO had received extensive training which covered the aspects of the 1988 TBWD scram, and had practiced performing the procedure in the simulator. It was concluded that the NCO was familiar with the procedure and that familiarity (or lack thereof) of the test procedure/methods for the TBWD did not influence subsequent events.

Lastly, the effect of a pending design change on the TBWD circuitry was reviewed. Following the 1988 scram, and based on input from the BWR Owners Group Scram Frequency Reduction Committee, in September of 1988, Systems Engineering initiated a design change to the test circuitry which would entirely bypass the TBWD trip circuitry during testing. The design change consisted of installing a keylock bypass switch on the TBWD panel and was scheduled for implementation during the 1991 refueling outage.

APPARENT CAUSE OF OCCURRENCE

The initiating cause of this event was the failure of the TBWD limit switch, TWS-11. The primary cause of this event, however, was the inadequate prioritization of the previously described design change.

PLANT TRANSIENT RESPONSE

All plant systems responded as expected with the exception of the system responses noted in the "Description of Occurrence". With respect to these exceptions, the post scram analysis determined the following:

1. The "P" SRV (lo-lo set, 1047 PSIG) did not lift due to a failed pressure transmitter. The transmitter was replaced and retested satisfactorily prior to plant restart.
2. The "M" SRV lifted because the "P" SRV did not. A review of GETARS printouts indicates that reactor pressure increased to approximately 1090 PSIG, which is within the setpoint range of the "M" SRV (with tolerance of the SRV and reactor pressure instrumentation considered). It was determined that the lifting of the "M" SRV was proper.

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PLANT TRANSIENT RESPONSE, CONT'D

3. With respect to the improper rod position indication on control rods 34-27 and 34-11, troubleshooting determined that the position indication probes for these two rods required replacement. The probes are currently bypassed, awaiting replacement at the first available opportunity.
4. SDV drain valve 1BF-HV-F011 was tested to determine if a problem existed with the valve or associated position indication. Stroke time testing indicated that the valve was stroking within acceptable time limits, however, closing stroke times indicated a need for increasing the surveillance frequency on the valve from quarterly to monthly. This has been accomplished, and appropriate ASME Section XI Inservice Testing followup will be conducted. No problems were noted with the associated position indication.
5. Troubleshooting on Reactor Recirc Pumps "A" and "B" determined that the inability to immediately restart these pumps stemmed from the timing sequencer controls. The timing sequencer was cleaned and retested satisfactorily.

PREVIOUS OCCURRENCES

As noted elsewhere in this report, a similar scram occurred on August 26, 1988 (refer to LER 88-022-00). However, the failure mode of the TBWD limit switch was different, as such, the corrective actions as described in LER 88-022 (test method changes) would not have prevented this occurrence.

SAFETY SIGNIFICANCE

The potential safety impact of this event was minimal, as a plant scram is an analyzed event, and with minor exceptions, all systems responded as expected. None of the abnormal system responses posed a threat to the ability to achieve and maintain safe shutdown conditions. This event posed no threat to the health and safety of the general public.

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CORRECTIVE ACTIONS

1. The design change to install a keylock bypass switch on the TBWD panel to entirely bypass the turbine trip circuitry during TBWD testing was implemented. Use of this switch will preclude any future turbine trips during TBWD testing.
2. TBWD limit switch TWS-11 was re-aligned and all terminal screws verified to be properly tightened.
3. A review of all previously identified scram reduction design changes was accomplished to ensure proper prioritization of these changes.
4. A review of all other turbine trip test procedures will be conducted to ensure that adequate procedural cautions exist to prevent a trip and that adequate physical trip lockout protection exists to prevent such a trip.
5. Systems Engineering will evaluate the effectiveness and frequency of preventive maintenance activities on the Recirc Pump timing sequencer.
6. The Nuclear Training Department will incorporate a review of this event into appropriate lesson plans and training courses.

Sincerely,

J. J. Hagan
General Manager -
Hope Creek Operations

RBC/

SORC Mtg. 90-010

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Figure "Attachment 1 Thrust Bearing Wear Detector Panel" omitted.

ATTACHMENT 1 TO 9002080103 PAGE 1 OF 1

PSE&G

Public Service Electric and Gas Company P.O. Box 236 Hancocks Bridge,
New Jersey 08038

Hope Creek Operations

January 29, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
UNIT NO. 1
LICENSEE EVENT REPORT 89-025-00

This Licensee Event Report is being submitted pursuant to the
requirements of 10CFR50.73 (a) (2) (iv).

Sincerely,

J.J. Hagan
General Manager -
Hope Creek Operations

RBC/

Attachment
SORC Mtg. 90-010

C Distribution

The Energy People

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